these periods a uniform price will be below the costs imposed by additional traffic and will send inefficient signals.[29]

Because calling distributions are uneven, with one or perhaps two pronounced peaks during the day, the optimal pricing structure would set non-zero prices for only a few hours when traffic is at or near its peak. Prices would be relatively high for most of this time, since prices charged for only this subset of traffic would recover almost all costs of increasing capacity. Compared with this optimal price structure the uniform price per minute will be lower since it will be calculated by dividing capacity costs by total traffic. Optimal prices will vary by time, and some of the lower, non-zero prices might be about the same level as a uniform price, but that would occur only by chance and likely for only a small portion of the day.

A uniform price per minute might be correct "on average," in the sense that average revenue per minute might be about the same as with optimal prices. This is a case, however, where being right on average means being wrong almost all of the time. The uniform price per minute is nearly always too high or too low, and both deviations create inefficiencies. Charging too high a price inefficiently discourages use: consumers fail to make some calls that would benefit them, even though those calls would impose virtually no costs. Charging too low a price inefficiently encourages use: consumers make calls they value less than the costs of making them. The economic term "deadweight losses" is given to reductions in welfare from prices that are too high and too low. Uniform prices will generate deadweight losses for most traffic.

Bill and Keep

Bill and keep sets a price of zero for sending additional traffic for termination. This is the optimal price and generates no deadweight loss for traffic that imposes no capacity costs. A very large part of traffic outside the system busy hour will impose no capacity costs, and much of the rest will impose only minimal capacity costs.[30] This

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[29] Optimal pricing that varied by time would smooth the peak calling, and thus there would be more than a single busy hour when additional calling would impose capacity costs.

[30] Some traffic outside the system busy hour may impose some capacity costs because not all network facilities experience their busy hour during the system busy hour. Additional traffic at times when

means that bill and keep's price of zero is the optimal price for a very substantial portion of total traffic, and a near-optimal price for other non-busy hour traffic. In the composite traffic profile for cellular systems presented in Figure 1, over 91 percent of total traffic during the business day is carried outside the cellular system busy hour; the proportion of total traffic outside the busy hour presumably is even larger over the entire week or month.[31] For the pricing of termination service by the LEC it really is the amount of CMRS traffic terminated by the LEC during the LEC busy hour that is relevant. The proportion of cellular traffic that is delivered for termination outside the LEC busy hour could well be still larger than the proportion calculated with reference to the cellular system busy hour.[32]

Bill and keep, however, does not send optimally efficient pricing signals for all of the interconnected traffic. The bill and keep price of zero is too low during the busy hour or, more generally, for traffic that does impose capacity costs on the terminating carrier. A uniform price per minute also is too low a price for busy hour traffic. Nevertheless, since a uniform price is higher than the zero, it will be closer to the optimal price and generate smaller deadweight losses for this traffic at these busiest time of usage than bill and keep.

In sum, neither a uniform price per minute nor bill and keep always send optimal pricing signals. A uniform price will almost always be either too high or too low. Bill and keep's price of zero will send the right signals for what likely is a substantial

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no facilities have their busy hour will impose no capacity costs. Additional traffic at times outside the system busy hour, but when some individual network facilities used by the interconnected traffic have busy hours, will impose some capacity costs. The capacity cost per minute for such traffic, however, will be very low relative to capacity cost per minute in the system busy hour so long as the facilities with their busy hour at that time constitute a small proportion of traffic sensitive network facilities.

[31] No, or almost no, weekend traffic will impose any capacity costs.

[32]Prices that varied optimally by time would smooth and spread traffic peaks, increasing the proportion of traffic that pressed on capacity and decreasing the proportion of traffic that should be charged a price of zero. Prices that vary hour by hour, however, are very unlikely to be practical. The closest feasible approximation is likely to be uniform pricing throughout some peak period. Such pricing will depress all calling within the period, and will not achieve the peak smoothing of optimally varied prices. Thus with any feasible set of pricing, the traffic profile is likely to continue to have a peaked busy hour, and it likely will continue to be true that most traffic will impose only minimal capacity costs.

majority of all traffic, but departs further from the optimal signal than does a uniform price during the times when usage imposes capacity costs on the terminating carrier. In the absence of detailed cost and demand information, no clear-cut conclusion is possible about which pricing structure, on balance, sends more efficient (or less inefficient) pricing signals.

4. Bill and Keep versus Peak/Off Peak Usage Pricing

Usage charges do not have to be uniform, and a standard response to the problem of recovering capacity costs with usage charges, both in theory and in the practice of telephone pricing, has been to set higher charges for peak than off-peak usage. Can the inefficiencies of uniform prices be overcome by setting peak and off-peak rates?

Theoretical studies of optimal peak/off-peak pricing have assumed a particular pattern of demand for usage: uniform demand within each pricing period, with demand at a high and uniform plateau during the peak period, and a uniform but lower plateau during an off-peak period. This pattern makes it optimal to set just two price levels (with the off-peak price usually at zero). But in practice the pattern of telephone usage varies from hour to hour. A quick look back at the optimal pricing structure derived earlier suggests that such two-period peak/off-peak structures also fall short of optimality. Peak/off-peak structures typically identify just two or three rate periods, and charge uniform rates within each. In contrast, in the example of an optimal rate structure above, several different non-zero rates were necessary in order to smooth the traffic peak. For the usage patterns typical of telephone traffic, there is no peak period during which a uniform, relatively high price would be charged.

Setting theoretically optimal prices that differ from hour to hour will not be feasible in practice.[33] It will be difficult and costly to collect the detailed demand information necessary to calculate such prices, demand may be constantly shifting and require frequent changes in peak pricing periods, and it is costly to collect charges based

[33] The concept of feasible prices is discussed in Park and Mitchell, *op. cit.*, pp. 5-6.

on such prices.[34] Furthermore, consumers likely would find it difficult to deal with such complicated pricing structures (assuming they were reflected in retail pricing). Varying prices would be unlikely to have the desired effect on consumer calling, even if implemented, because consumers are unlikely to understand and know the varying prices of calling at various times. In practice, only pricing structures that are feasible can (or should) be implemented. Simple peak/off-peak pricing with two or three pricing periods is feasible. Like uniform prices and bill and keep, however, simple peak/off-peak prices do not send fully optimal price signals. The question again is, how far do they depart from optimality? To clarify the exposition, we discuss only the case of two pricing periods.

Off-peak prices are easily evaluated -- assuming that the off-peak period is set so that no additional traffic during this period imposes capacity costs. Off-peak prices set at zero will be optimal, just as bill and keep sends optimal price signals for this traffic. If off-peak prices are not zero, they should still be lower than a uniform price, in which case they will impose smaller deadweight losses than the uniform price, but greater deadweight losses than the zero price of bill and keep.

The effect of the peak period rate is more complicated. Peak periods typically are relatively long; often, for example, they cover regular business hours or more. Such periods certainly will be longer than the system busy hour of the terminating carrier. Some facilities used by terminating traffic will have busy hours outside the system busy hour, but a long peak period almost surely will extend over periods when additional traffic imposes no capacity costs. Applying the peak period rate to this traffic generates a

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[34] In fact, optimal pricing that fully took into account the variability in demand and cost would be even more complicated. Demand varies systematically not just by hour of the business day, but by day of the week and time of the year. Furthermore, the level of demand does not shift sharply when the hour is struck, but varies continuously across time. As suggested above, different network facilities will face congestion at different times and facility cost will vary by location. Fully optimal pricing in principle would take this into account, varying price not only with time of day but with the routing of the call.

deadweight loss. Furthermore, the peak period price generates a larger deadweight loss for this traffic than the uniform price because it is higher.[35]

The peak period price also is likely to be too low during some of all of the portion of the peak period when additional traffic does impose capacity costs. Because the peak period still includes traffic that does not impose capacity costs, the calculated price will be lower than optimal for some or all traffic that does impose capacity costs. In effect, pricing in the peak replicates the pattern of inefficiencies of uniform pricing. Peak period prices may be right "on average" over the period, but will be too low for some traffic, too high for most of the rest of the traffic, and just right only by accident.

A peak/off peak price structure should send more efficient pricing signals than uniform prices (so long as both generate the same total revenue).[36] It still is not possible, however, to reach any general conclusion about the relative efficiency of pricing signals from peak/off peak usage pricing and bill and keep arrangements. As before, the ranking depends on detailed cost and demand information, and now on the design of peak/off peak pricing as well.

5. Level of Pricing

The discussion so far has focused only on effects of the structure of usage sensitive price. The assumption has been that the cost of capacity was known, and that usage prices do no more than recover the capacity costs imposed by terminating traffic. In other words, the implicit assumption has been that the overall level of usage based prices was correct, and the only issue was the effect of the structure of those prices. In

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[35] The optimal time-varying pricing structure described above also charged non-zero prices outside the busy hour. These prices, however, varied depending on demand, order to smooth off the peak of the traffic distribution. Prices varied so that demand was not suppressed by more than was necessary to smooth the traffic distribution. A uniform peak period price will tend to suppress demand more than is necessary during some hours of the peak period outside the busiest hour, and this generates a deadweight loss.

[36] This assumes that the peak and off peak periods are not set perversely, for example by setting a peak period that does not include the busy hour. In principle it should always be possible to do at least as well as with uniform prices, since uniform pricing can be replicated by setting the same rate in the peak and off-peak period.

fact, these costs may not be known, or prices may not be set at the most efficient level.[37] If, for whatever reason, the level of usage sensitive prices is set too high, that will be an additional source of inefficiency. In particular, there is general agreement that interstate switched access charges are set well above costs. Setting usage prices at this level surely would impose additional efficiency losses. (As discussed below, setting high interconnection prices is also likely to deter the development of competition and impose losses of dynamic efficiency.)

VI. The Effect of the Compensation Arrangements on Transactions Costs

The efficiency of price signals is not the only criterion for evaluating the efficiency of compensation arrangements or choosing among them. A second criterion is the effect of compensation arrangements on cost.

A. Tradeoffs: Triangles and Rectangles

In economic theory, overall efficiency depends on satisfying a number of conditions. Having the appropriate price signal -- in textbook theory setting price equal to marginal cost -- is only one of these conditions. A second condition necessary to achieve efficiency is to produce in the most efficient possible way and to minimize cost for any given level of output. Ideally, one both minimizes cost and obtains efficient pricing signals.

Sometimes, however, that may not be possible. It may be costly to get sufficient cost information to price "perfectly." Or it may be costly to monitor usage and collect revenue. One then has to tradeoff the effects on efficiency of a better price signal but higher costs, against a less accurate price signal but lower costs.

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[37] The question of the efficient level of pricing raises many complicated issues whose discussion is beyond the scope of this paper. Among these are questions of whether prices should be set to recover long or short run costs, marginal or total service incremental costs, and whether markups above (some measure of) cost are appropriate, and if so what are appropriate justifications for such markups. For discussions of some of these issues see Bridger M. Mitchell, Werner Neu, Karl-Heinz Neumann and Ingo Vogelsang, "The Regulation of Pricing of Interconnection Services" in G. R. Brock, ed., *Toward a Competitive Telecommunications Industry*, Lawrence Erlbaum Assoc, 1995.

Figure 3 illustrates such a tradeoff with a simple graph of demand and cost. D is the demand curve, showing the amount consumers would purchase at each price. MC_1 plots the constant marginal cost of additional output, absent any costs of charging and collecting a price. The optimal solution, if it were possible, would be to charge P_1, where price equals marginal cost, in which case consumers would buy (and producers would produce) the quantity Q_1. Assume, now, that collecting a price for each unit consumed will increase marginal cost, because each unit sold must be recorded and revenue collected. If a price is charged, marginal cost increases to MC_2. Now the combination of P_1 and Q_1 is unachievable. The choice is between charging a price of zero with consumption of Q_0, and setting price at P_2, (equal to the higher MC_2 with non-zero prices), in which case quantity consumed declines to Q_2. The combination of a price of zero and Q_0 generates a deadweight loss shown by the shaded triangle A.[38] This represents the difference between how much consumers value the additional units of output, given by D, and the larger amount it costs to produce them, given by MC_1. If instead a price is charged, the efficiency cost is the increase in cost for each unit of output, which is shown by the shaded rectangle B.[39] Overall, failing to charge a price for output will be more efficient if the deadweight loss of triangle A is smaller than the rectangle B.

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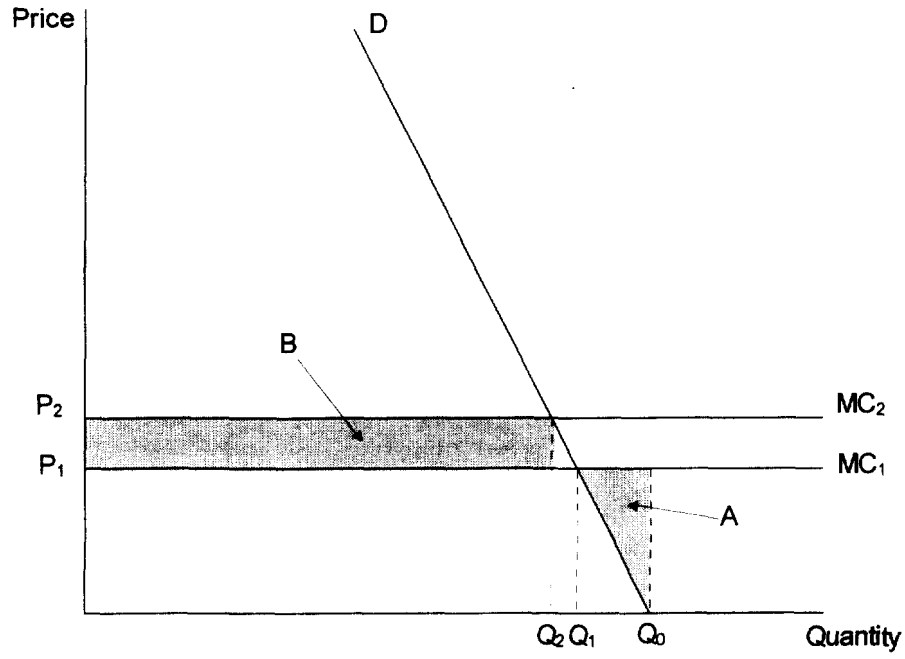
[38] To simplify, we assume that the producer has other ways of collecting revenue to cover the costs of producing Q_0. For example, the "product" here might be packets of ketchup at McDonald's, which can charge a separate price for each ketchup packet, or cover the cost by charging slightly more for hamburgers. The slightly higher price for hamburgers in this example would generate an additional deadweight loss that should be added to that shown in Figure 2 to calculate the full effect of giving away ketchup packets.

[39] The rectangle represents the increased cost per unit of output, MC_2 - MC_1, times the output of Q_2.

Figure 3
Efficiency Trade-off: Deadweight Loss Versus Higher Transaction Costs



B. Costs with Bill and Keep and Usage Sensitive Pricing

Under bill and keep, neither the LEC nor CMRS provider needs to track or bill for the amount of interconnected traffic it receives from the other carrier. These functions, and their costs, are necessary with usage sensitive pricing.

Usage sensitive compensation arrangement will unquestionably impose higher transactions costs than bill and keep arrangements, although it is not clear that incurring these costs will necessarily lead to more efficient pricing signals. The analysis of the previous section showed that neither usage sensitive pricing nor bill and keep is able to send fully optimal pricing signals. Nor does the analysis support a general conclusion that usage sensitive pricing will necessarily send better, more efficient pricing signals than bill and keep compensation arrangements, as the efficiency of the signals sent by usage sensitive pricing will vary with the structure and level of those prices. In either case, the higher costs of administering usage sensitive pricing are a factor counting in

favor of bill and keep arrangements, either as an offset to somewhat less efficient pricing signals with bill and keep, or as a factor augmenting the bill and keep's more efficient pricing signals.

Survey responses from CTIA members identified various types of costs they would save with bill and keep compensation arrangements. If they no longer had to make usage sensitive payments for traffic sent to LECs, they would save costs of administrative and financial personnel and supporting services necessary to audit, reconcile, verify, and pay bills. One system indicated that it employed two full time clerks to handle LEC billing, and another that one full time staff member was devoted to analyzing bills from the LEC. Most cellular systems answering the questionnaire are not now paid for the termination of LEC-originated traffic. If compensation for these costs were based on usage payments rather than bill and keep arrangements, respondents indicated they would incur personnel and other costs to collect the necessary data, to prepare bills, to handle accounts receivable and payable, and to manage the process. Several systems also reported that they do not now have the ability to measure traffic received from LECs, and that adding this capability would involve a significant expense.

Finally, it is worth noting that some of the transactions costs must be committed up-front to implement usage sensitive pricing. Such costs likely include the costs of regulatory proceedings to collect cost information and set rates, the cost to providers of establishing procedures, developing software, and training personnel to implement the pricing, and the costs of any special equipment that must be installed to measure usage. Once these costs are incurred, there is no way to go back and undo them, or reduce their burden, if usage sensitive pricing proves suboptimal and a shift is made to bill and keep or some other compensation arrangement.

VII. Effects on Competition and Dynamic Efficiency

We have analyzed how compensation arrangements, by influencing pricing signals and transaction costs, affect static efficiency. The analysis of pricing signals asks how pricing affects consumers' usage of a given set of services and suppliers. The analysis of transactions costs asks how costs of given services and suppliers are affected

by the choice of compensation arrangements. We now address the additional question of how compensation arrangements may, over time, affect changes in the range of service provided, in the number of suppliers, and in extent of competition between suppliers.

Dynamic changes in the range of services provided and in the extent of competition are critical for long-term improvements in overall economic efficiency and the benefits consumers receive from telecommunications services. Greater competition increases efficiency and benefits consumers in at least three general ways. First, increased competition limits the ability of suppliers to exercise market power and lowers the prices consumers must pay. Where regulation has heretofore been used to constrain the exercise of market power, competition can substitute for regulation, saving the various costs imposed by regulation. Second, increased competition puts increased pressure on suppliers to find ways to reduce costs. Third, increased competition puts increased pressure on suppliers to innovate and improve the quality of the service provided. Consumers of both incumbent suppliers and of new, competing suppliers all benefit from greater competition.

Consumers also benefit from dynamic efficiency when new services are complements to existing services that increase the demand from existing suppliers, rather than substitutes that increase competition. The availability of the new complementary services provides direct benefits to consumers.

We discuss below how the choice of compensation arrangements influences market entry and the structure of retail prices and thus affects dynamic efficiency, the level of competition, and the development of new services.

A. Effects on Entry and Competition

The availability and cost of interconnection service to terminate calls to customers served by other carriers will be crucial for the competitive viability of CMRS providers and indeed for all competitive local service providers. Interconnection is valuable to LECs and to CMRS and other local service providers. The competitive significance of interconnection and its costs, however, rests on the strongly asymmetric importance of interconnection costs for LECs and for CMRS and other local providers.

The costs of obtaining interconnection services will have a much bigger impact on CMRS providers and other emerging local service providers than on LECs simply because of differences in the number of subscribers each provider is likely to have for the foreseeable future. So long as a CMRS provider or other competing local carrier has relatively few subscribers, a high proportion of the calls its subscribers place will have to be terminated "off-net" by LECs. Conversely, a high proportion of the calls placed by LEC subscribers will remain "on net" to other LEC subscribers and only a small proportion will terminate to the relatively small number of subscribers served by other providers. This phenomenon was illustrated in the hypothetical example discussed in an early section of the paper and presented in Table 1.

The difference in the proportion of calls terminated by an interconnected carrier causes a difference in the relative importance to the two carriers of the price of interconnection service. Interconnection costs will be a major component of total costs for CMRS providers and other emerging local services because such a high proportion of calls placed by their subscribers will require termination by the LEC. Conversely, interconnection costs will be a much smaller component of costs for LECs because a much smaller proportion of calls they originate will require termination by another carrier. LECs will self-supply termination service for most of the calls for which they provide origination service. In effect, LECs will be vertically integrated producers supplying end-to-end service for a high proportion of the calls their subscribers make, whereas CMRS providers and emerging competitive local carriers will have to rely on purchased inputs (termination service) for most of their product. Because the smaller carriers use much more of the purchased input per unit of output, their overall costs will be much more dependent on the price of the purchased input.[40]

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[40] Saying that the competitive distortion arises because of differences in the extent to which LECs and CMRS providers are vertically integrated or must purchase upstream inputs from downstream competitors may suggest regulation could solve the problem by requiring imputation. This, however, would require a vast expansion of regulatory oversight, unlikely to be either practical or effective. This solution would require LECs to impute the price charged CMRS providers for termination as a cost to local calls that LECs both originate and terminate. Imputation could not be enforced through use of separate subsidiaries since it would be impossible to divide the LEC into separate subsidiaries, one of which provides termination (both to CMRS providers and a LEC subsidiary) and another that provides origination

Consequently, the level of the price for interconnection services will have a crucial effect on competition between LECs and new service providers. A price for interconnection that is too high has only a small impact on a LEC's cost of serving a typical subscriber, and thus a small impact on the prices the LEC must charge. On the other hand, if CMRS providers, or other would-be competitors for LECs, must pay too high a price for interconnection, that will substantially increase their cost of providing service and substantially increase the prices they must charge. The result for competition will be either that the CMRS providers or other new carriers will not be viable and will not enter the market, or that they must charge higher prices. Either case results in much less competitive pressure on LEC prices.

High interconnection prices may not prevent mobile services from being viable but they may confine mobile services solely to complementing LEC wireline service, rather than also serving as substitutes. If CMRS is substantially more costly than wireline service, due in part to high interconnection costs, consumers will not substitute CMRS for LEC service in applications where either service could be used. Instead, CMRS will be used predominantly in applications that wireline service cannot provide. In these circumstances CMRS could still be viable, and indeed could still continue to grow rapidly because complementary services also are valuable. Nevertheless, interconnection prices that are too high still impose a cost in lost dynamic efficiency. First, consumers will pay too much for the complementary service, and the entry of additional suppliers of such service may be deterred. Second, because CMRS service cannot *also* serve as a substitute for LEC service, the benefits of increased competition for this type of service are lost.

Granted that high prices for interconnection service can hinder competition and harm dynamic efficiency, what does this imply for a choice between compensation arrangements? Can't inefficiently high prices for interconnection service be avoided regardless of which compensation arrangement is chosen? The answer is that, in

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for local calling, purchases termination service from the other LEC subsidiary, and retails the end-to-end call. Imputation could be enforced only by direct oversight of retail pricing of local calling and local

principle, interconnection services need not be priced too high regardless of the compensation arrangement, but under bill and keep the *risk* that they will be priced incorrectly and too high is reduced.

Under bill and keep arrangements the amount each provider must pay to get interconnection services from the other does not depend on regulatory authorities having accurate information and making difficult decisions. To receive termination for the calls its subscribers place to other networks, the carrier must bear the costs of terminating calls received from the other carrier. Each provider can go about handling that traffic in the most efficient way and at the lowest possible cost. The cost of interconnection services is largely unaffected by regulatory decisions.[41] Furthermore, bill and keep arrangements can be put in place quickly without the need for lengthy regulatory proceedings.

With usage sensitive pricing, the cost of interconnection services to a provider depends on the price level that is set. There is a substantial risk that this price will be too high if regulation specifies only the structure of rates, but not their level. In negotiated arrangements, as discussed earlier, a LEC will have substantially greater bargaining power than CMRS providers. In addition, the LEC can disadvantage competing suppliers with a higher price for interconnection service, even if regulation forces the LEC to pay the same high price per minute for reciprocal interconnection. Because LECs use far less of these services, raising the price will raise the costs of rivals relative to their own costs.

The character of the risk changes somewhat if interconnection prices are set or constrained by regulation. Now the effect of the price level on the development of competition depends directly on regulatory decisions. For example, if regulators rely on existing switched access charges that have been set to generate substantial contribution above cost, interconnection price levels are virtually certain to be too high.

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service. That also would be a daunting regulatory task, to put it mildly.

[41] The same will be true for the costs of the dedicated trunks used for interconnection if those costs are shared by having each provider responsible for the cost of the trunk to some meet point that is midway. The cost of this trunk to each provider will depend on regulatory oversight of pricing if, instead, a pricing mechanism is used to apportion costs. It should be easier, however, to set a price accurately based on cost for a single, well-defined facility dedicated to a particular use than for shared use of a network.

In order to establish new rates that are not too high, regulators will require accurate information on cost, which can be difficult and costly to collect. These undertakings create a series of problems and risks. First, regulators must rely at least in part on LECs for information on the costs of terminating traffic on the LEC network. For the reasons already given, LECs may have an incentive to claim high costs in order to justify higher prices. Second, attempts to collect cost information from CMRS providers and other local carriers are likely to impose substantial costs on those providers. Such costs themselves in effect increase the market entry costs of new carriers. Third and more generally, because regulatory decisions on interconnection pricing will be crucial to the business fortunes of these smaller carriers, they may need to participate to provide a balanced record in order to reduce the risk of regulatory decisions based only on LEC comments. Relative to total cost, the cost of participating in regulatory proceedings will be much more burdensome for small carriers than for LECs. Fourth, collecting cost information and determining new rates is likely to take time. Delays in setting interconnection rates and uncertainty about interconnection pricing increase the risk faced by new providers and will likely reduce or delay the investment in expanded capacity and new services other providers will be willing to make.

B. The Structure of Interconnection Pricing and Retail Pricing

The structure of prices CMRS providers pay for interconnection services, as well as their level, can also distort the development of competition. A previous section analyzed how the structure of usage sensitive prices will depart from the structure of capacity costs a carrier incurs to provide termination. The emphasis in that analysis was on the distortion in pricing signals. Here the focus is on how differences in the extent of distortion faced by CMRS providers and LECs will affect the development of competition.

The price a carrier pays for interconnection service becomes part of its cost structure, which in turn affects the structure of its retail prices. As we have noted, terminating traffic outside its busy hour imposes little or no cost on the terminating carrier. If, notwithstanding, the originating carrier must pay for each additional minute

terminated, that traffic will be costly for the originating carrier, and that cost will have to be considered in setting the retail price to customers. That much is true for both CMRS providers and LECs when usage sensitive rates are charged for termination.

Where the two providers differ is in how much termination service each purchases from the other, and how much each self-supplies because the call goes "on-net" to another of its subscribers. A CMRS provider or LEC sees the true cost structure of termination for the calls it both originates and terminates on its own network; retail pricing for this "on-net" calling can be based on the underlying cost structure, not the cost structure created by prices of interconnection inputs.

The LEC self-supplies termination for most calls originated on its network and would purchase termination from the CMRS provider for only a small proportion of calls. The cost structure for most LEC calling will be the underlying cost structure of carrying the traffic, not one that would be imposed by termination service purchased at a per-minute rate. The LEC's retail price structure can reflect the fact that much calling in fact imposes little or no cost on the network. In contrast, a high proportion of calls originated by the CMRS provider, or by an emerging local competitor, will require termination service from the LEC. The cost structure for a high proportion of this provider's calling will therefore depend on the rate structure for termination service, and its retail rates for calling and service must in turn be based on that cost structure.

It is widely appreciated that one of the benefits of competition is that it pushes price closer to cost. Usually the emphasis is on competition preventing the level of prices from exceeding the level of costs. Competition also generates important benefits, however, by creating market forces that push the structure of prices to more closely match the structure of costs. That benefit will not be realized as fully if new local suppliers that expand competition incur costs that are heavily influenced by wholesale interconnection prices that differ substantially from the underlying cost structure. Furthermore, if new carriers gain significant market shares, the cost structure of LECs also will become more dependent on the price structure for interconnection services.

To some extent, this problem is a manifestation, at the level of retail prices, of the difficulty already discussed above of setting prices that match costs and send "optimal,"

efficient price signals. We already saw that neither usage sensitive prices nor bill and keep fully matches the underlying cost structure. Nor is any other feasible price structure likely to be fully optimal in this sense. This means both that there will be deadweight losses because prices, both retail and wholesale, depart from the underlying cost structures, and that the cost structure of a carrier will be more or less affected by this disparity, depending on the extent to which it relies on termination services supplier by other carriers. If fully optimal prices are not feasible, this problem can be fully solved only by eliminating competing carriers that must acquire interconnection services from other carriers -- and that surely is throwing the baby out with the bath water. While it may be impossible to eliminate the problem, the effect on retail pricing of choosing a compensation arrangement and wholesale price structure should be kept in mind. There still can be better and worse arrangements, even if there is no fully optimal result.

Differences between the cost structure of a CMRS provider that purchases most termination and the cost structure of a LEC that self-supplies most termination, can affect the ability of the carriers to compete for customers. In some cases, the different cost structures will give each carrier advantages with some types of customers and disadvantages with others. For example, uniform pricing could tend to increase the costs for a CMRS provider of serving customers with relatively large traffic volumes terminated outside the busy hour since this is when the uniform price exceeds the cost of termination. At the same time, the uniform price would tend to lower costs for the CMRS provider to serve customers with relatively large volumes of busy-hour traffic because this is when a uniform price (equal to average cost per minute) is lower than cost. The net impact of such effects may be difficult to determine without fairly detailed information on demand and costs.[42]

The net effect of other potential distortions may be clear. The following is offered as a possibility illustrating this general point. When a LEC sets a flat rate for retail

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[42] The impact of bill and keep on attracting customers may be more difficult to determine since it will depend on how a carrier recovers the costs imposed on it by having to provide termination service to the interconnected carrier.

service, much of the additional calling that is induced occurs outside the busy hour and would impose little additional cost since the LEC does not have to purchase termination. Carriers who must pay a uniform price per minute to terminate most calling, however, will find it more difficult to set flat rates for retail service than carriers who self-supply and see the underlying capacity costs of termination. For most of the calling of the carrier paying usage sensitive rates, every additional minute of calling terminated by another carrier increases cost.

As noted above, such a difference in retail price structures could differentially affect the ability of the carriers to compete for customers with different calling patterns. In addition, setting and collecting usage sensitive retail prices could impose increased transactions costs on the CMRS provider. If, but for the uniform price on termination, the CMRS provider would not set such usage sensitive retail prices and would not bear these additional transactions costs, choosing to impose uniform wholesale prices increases the overall costs of the CMRS provider relative to those of the LEC.[43] In addition, customers may have a clear preference for flat-rated pricing structures. Or, even if retail charges in any case would depend to some extent on usage, consumers might prefer tariff structures, such as purchases of blocks of time, that do not impose marginal prices for all additional usage. Carriers who must pay uniform prices for termination may find it unprofitable to offer such pricing structures, and that in turn could make the CMRS service less attractive to consumers. The retail pricing characteristics generated by the structure of wholesale prices would make it more difficult, in this case, for the competing CMRS service to attract subscribers.

VIII. Conclusions

In the future, it is likely that consumers increasingly will be able to choose among multiple networks for local telecommunications services. These networks -- both wireless and wireline, mobile and fixed, and supplied by CMRS, LECs, and CLECs --

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[43] If the carrier would in any case use usage sensitive retail pricing that was just as costly to implement, the additional costs could not be attributed to the structure of wholesale prices.

can be expected to offer an increased range of services and to compete directly with each other. However, consumers will only fully realize the benefits of multiple local telecommunications networks if the arrangements for interconnecting these networks are efficient. The Commission in its *Notice* asks for comments on one group of interconnection arrangements -- those between CMRS providers and LECs.

Interconnection arrangements are far more critical for CMRS providers, and other smaller networks, than they are for LECs. The proportion of a CMRS subscriber's originated and received traffic that requires interconnection will be much higher than the proportion for a LEC subscriber, simply because of the relative size of the CMRS and LEC networks. As a result, the cost and quality of interconnection will have a much greater impact on the cost and quality of CMRS service per subscriber than of LEC service. The resulting difference in the bargaining positions of the two providers means that negotiations between CMRS providers and LECs that are unconstrained by regulatory rules or controls are unlikely to yield efficient compensation arrangements for interconnection.

Consequently, the choice among compensation arrangements for interconnection between CMRS providers and LECs is a matter of importance for the Commission and for consumers. This paper has analyzed economic issues that should be considered in evaluating the advantages and disadvantages of bill and keep arrangements and of usage sensitive pricing for interconnection traffic. Accurately identifying the advantages and disadvantages of each compensation arrangement requires a systematic analysis that digs below the surface. Once that is done, the advantages and disadvantages of bill and keep arrangements and of usage sensitive pricing are not necessarily what they might appear to be at first sight.

- Both bill and keep and usage sensitive prices impose costs on carriers for the interconnection services they receive. To determine whether the costs of interconnection service provided to each carrier are balanced, one must analyze both the magnitude of interconnected traffic that imposes capacity costs and the magnitude of capacity costs per minute for each carrier; simply looking at the balance of total interconnected traffic is not sufficient. Information collected from CTIA members suggests that the costs that

interconnection imposes on CMRS providers and LECs may be more balanced than the total traffic flows between the two types of providers.

- Neither usage sensitive prices nor bill and keep arrangements send fully optimal pricing signals. Furthermore, without detailed demand and cost information, it is not possible to determine that price signals will be more efficient with either a uniform price or a peak/off-peak price structure for interconnected traffic than with bill and keep arrangements.
- Usage sensitive pricing will impose higher transactions costs to measure and bill for interconnected traffic than will bill and keep arrangements.
- The risk of hindering competition and reducing dynamic efficiency is greater with usage sensitive compensation arrangements than with bill and keep arrangements, because usage sensitive compensation arrangements risk setting excessive prices for interconnection service.

In the end, on the basis of available information, there is no simple case for asserting the clear superiority of usage sensitive pricing over bill and keep arrangements. Each arrangement has both advantages and disadvantages. In these circumstances careful attention should be given to the risks that usage sensitive pricing poses for the development of new and competing carriers that promise great benefits for consumers. Excessive prices for interconnected traffic can either block the entry of some carriers and their service, or prevent consumers from fully realizing the benefits of their entry and expansion. Even temporary reliance on excessive prices, while trying to establish prices better matched to the level and structure of costs, will delay the development of CMRS service and forego consumers benefits. In contrast, the immediate adoption of bill and keep interconnection arrangements between LECs and CMRS providers, at least on an interim basis, will ensure that the development of these services is not handicapped by interconnection arrangements that impose excessive prices.

COMMISSION PREEMPTION OF INTERCONNECTION RATES

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In 1993, Congress gave the Federal Communications Commission authority to preempt state regulation of the interconnection rates between commercial mobile radio service (CMRS) providers and local exchange carriers (LECs). This legislative action empowers the Commission to create uniform national policy in this vital area. The Telecommunications Act of 1996 explicitly reserves this power.

Strong agency action in this field will continue the historic role the Commission has played in transforming communications in the United States. In 1985, a comprehensive survey of the field noted with favor that over the previous fifteen years, "the FCC, wielding its preemptive power, succeeded in largely

reshaping the domestic telephone industry."[1] It is imperative that the agency continue to use preemption to strengthen our nation's communications system.

This memorandum is divided into two parts. The first demonstrates that, in light of the 1993 legislation and classic preemption principles, the Commission has exclusive power over LEC to CMRS interconnection compensation rates. The second shows why it is particularly appropriate, given the United States Supreme Court's *Chevron* decision and the dangers of inefficient state regulation, that the Commission use this power to create a uniform national standard in this area.

I

The federal preemption power flows from the Supremacy Clause of the United States Constitution, which provides that, "This Constitution, and the Laws

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[1]Richard McKenna, *Preemption Under the Communications Act*, 37 FED. COM. L. J. 1, 4-5 (1985). McKenna explains:

> Over the last fifteen years, the telephone industry in the United States has been transformed. In terms of industry structure, competition, regulation, legal theory and practice, and impact on the consumer, among other things, there are vast differences between the environment of 1984 and of the 1960s. *FCC preemption has been a key factor in bringing about these dramatic changes. Id.* at 2 (emphasis added).

of the United States which shall be made in Pursuance thereof....shall be the supreme Law of the Land....any Thing in the Constitution or Laws of any State to the Contrary notwithstanding."[2] One of the "Laws of the United States" that has been given the broadest preemptive power by the Supreme Court has been the Communications Act of 1934, which the Court has interpreted to give the Federal Communications Commission "comprehensive authority," including, for example, "'broad responsibilities' to regulate all aspects of interstate communication by wire or radio...."[3]

In considering the Commission's authority, one must recognize that the Court has held that "[f]ederal regulations have no less pre-emptive effect than federal statutes."[4] Indeed, when "Congress has directed an administrator to exercise his discretion," and he has done so appropriately, a "pre-emptive regulation's force does not depend on express congressional authorization to

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[2]U.S. Const., Art. VI, cl. 2.

[3]Capital Cities Cable, Inc. v. Crisp, 467 U.S. 691, 700 (1984)(citing United States v. Southwestern Cable Co., 392 U.S. 157, 177-178).

[4]Fidelity Federal Savings & Loan Association v. De La Cuesta, 458 U.S. 141, 153 (1982). *See also* United States v. Shimer, 367 U.S. 374 (1961).

displace state law...."[5] Thus, as the Court emphasized in a unanimous opinion involving the Federal Communications Commission, "if the FCC has resolved to pre-empt an area ... and if this determination 'represents a reasonable accommodation of conflicting policies' that are within the agency's domain ... we must conclude that all conflicting state regulations have been precluded."[6]

It is against this backdrop that we must analyze the question of CMRS - LEC interconnection policy. The Communications Act of 1934 creates a dual regulatory scheme for certain interstate and intrastate communications: Section 152(a) gives the Commission exclusive jurisdiction over "all interstate and foreign communication by wire or radio,"[7] while Section 152(b) limits Commission jurisdiction and thus retains state authority over "charges ... in connection with intrastate communication service by wire or radio...."[8] In 1993, however, Congress

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[5]Fidelity Federal Savings & Loan Association v. De La Cuesta, 458 U.S. 141, 153, 154 (1961).

[6]Capital Cities Cable, Inc. v. Crisp, 467 U.S. 691, 700 (1984).

[7]*See* 47 U.S.C. §152(a).

[8]*See* 47 U.S.C. §152(b). Of course, technology has blurred the lines between interstate and intrastate matters. *See, e.g.*, Louisiana Public Service Commission v. Federal Communications Commission, 476 U.S. 355, 360 (1986).

amended the Act in dramatic fashion. Section 332(c)(3), titled "State preemption", now provides that, "Notwithstanding section[] 152(b) ... of this title, no State or local government shall have any authority to regulate the entry of or the rates charged by any commercial mobile service ... except that this paragraph shall not prohibit a State from regulating the other terms and conditions of commercial mobile services."[9] The words "entry" and "rates" are, of course, clear; the residual state power over "other terms and conditions" concerns, according to the House Report, such matters as "customer billing information and practices and billing disputes."[10]

The 1993 legislation further emphasized the pre-emption of state authority in two important ways. First, Section 152(b), the source of state power over intrastate matters, now begins with the phrase, "Except as provided in ... section 332 of this title ...."[11] Second, §332(c)(3), after ousting preexisting state authority over rates, enables a state to petition the Commission for authority to regulate the rates for any commercial mobile service, but then provides that if the Commission grants such a

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[9]47 U.S.C. §332(c)(2).

[10]H.R. Rep. No. 103-111, 103rd Cong., 1st Sess. 261 (1993).

[11]47 U.S.C. §152(b).

petition, "the Commission shall authorize the State to exercise ... such authority over rates ... *as the Commission deems necessary to ensure that such rates are just and reasonable and not unjustly or unreasonably discriminatory.*"[12]

Thus Congress has spoken clearly. Traditional §152(b) state authority over intrastate matters has been displaced in this area. It is the Commission that now makes the vital decisions, including whether or not to authorize further state involvement. The Supreme Court has emphasized in the Communications Act context that "the best way of determining whether Congress intended the regulations of an administration agency to displace state law is to examine the nature and scope of the authority granted by Congress to the agency."[13] Here such an examination clearly reveals that state law is displaced.

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[12]47 U.S.C. §332(c)(3)(A)(emphasis added). *See also* 47 U.S.C. §332(c)(3)(B) which gives the Commission the power to authorize a state to continue to use preexisting rates for any commercial mobile service.

[13]Louisiana Public Service Commission v. Federal Communications Commission, 476 U.S. 355, 374 (1986).